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Factors Influencing Effective Construction Materials Management among Construction Firms in Anambra State, Nigeria

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Abstract: *Effective materials management remains a critical determinant of construction project success because construction materials constitute a substantial proportion of total project costs. However, many construction firms in Nigeria continue to experience project delays, cost overruns, material wastage, and low productivity due to inefficiencies in planning, procurement, storage, handling, and inventory control. Although previous studies have examined materials management challenges in the Nigerian construction industry, limited empirical evidence exists on the relative influence of the different categories of factors affecting materials management effectiveness among construction firms in Anambra State. This study therefore aimed to assess the factors affecting effective materials management practices among construction firms in Anambra State, Nigeria, and to determine their relative influence on materials management effectiveness. A descriptive survey research design was adopted, targeting project managers, site engineers, chief executive officers, directors, procurement officers, and other key personnel in registered construction firms. A total of 220 structured questionnaires were administered, of which 205 valid responses, representing a 93.2% usable response rate, were analysed. Descriptive statistics, including mean scores and ranking, were used to identify the major factors affecting materials management practices, while Multiple Linear Regression Analysis was employed to determine their significance and relative influence. The findings revealed that all identified factor categories significantly influence effective materials management practices. Planning and handling factors were ranked as the most influential, followed by site condition factors and management factors, while governmental factors recorded the least influence despite remaining statistically significant. The regression analysis established a strong relationship between the identified factors and materials management effectiveness ($R = 0.882$), with the model explaining 77.8% of the variation in materials management effectiveness ($R^2 = 0.778$). Planning and handling factors exerted the strongest predictive effect, followed by suppliers and manufacturers' factors and management factors. The overall regression model was statistically significant ($F = 110.42$, $p < 0.001$), confirming that the identified factors jointly influence effective materials management practices. The study contributes to knowledge by empirically establishing the relative predictive influence of the major materials management factor categories within the context of construction firms in Anambra State, thereby providing a context-specific basis for prioritising interventions. In practice, the findings provide construction firms and industry stakeholders with an evidence-based basis for improving planning, site organization, supplier coordination, managerial practices, transportation systems, contractual administration, and regulatory support. The study recommends the adoption of integrated materials management systems supported by digital technologies such as Building Information Modelling (BIM), Enterprise Resource Planning (ERP), and Radio Frequency Identification (RFID), alongside policies that strengthen construction supply chain efficiency and project performance in Anambra State.*

Keywords: Inventory control, construction supply chain, project management, planning and handling, procurement practices, multiple regression, Anambra State.

1.0. INTRODUCTION

The construction industry is a major contributor to economic growth, infrastructure development, employment generation, and urban transformation across developed and developing economies. Through the provision of residential, commercial, industrial, and public infrastructure, the sector supports economic and social development while contributing substantially to national economic activity (World Bank, 2023; Annor, Jacobs, Abdelaty, & Haupt, 2025). Despite this importance, construction projects

continue to experience persistent problems of cost overruns, delays, material wastage, quality deficiencies, and low productivity. These challenges are particularly significant because construction materials constitute approximately 50% to 70% of total project costs, making the efficient management of materials an important determinant of project performance (Mahadi & Mizal Azzmi, 2023). Materials management encompasses the planning, procurement, transportation, inspection, storage, handling, inventory control, and utilization of materials required for project execution. When these activities are effectively coordinated, materials are made available in the required quantity, quality, location, and time, thereby supporting uninterrupted workflow, reducing waste, improving productivity, and controlling project costs (Ofori-Kuragu, Baiden, & Badu, 2021).

The effectiveness of materials management is influenced by a combination of interconnected organizational, operational, supply-chain, and external factors rather than by a single management activity. From a planning and operational perspective, accurate materials forecasting, timely procurement, proper handling, adequate storage, and effective inventory control are important for preventing shortages, overstocking, deterioration, and unnecessary material movement. Poor planning and handling can interrupt site operations and increase material losses and project costs (Albert, Shakantu, & Ibrahim, 2021). From a supplier and supply-chain perspective, supplier reliability, product availability, quality consistency, delivery performance, and coordination among contractors, manufacturers, suppliers, and other project participants determine the continuity of material flows. Fragmented supply chains and weak coordination can result in procurement delays, inconsistent material quality, and disruptions to construction activities (Ofori-Kuragu et al., 2021). These relationships indicate that materials management should be examined as an integrated supply-chain process rather than as an isolated site activity.

The management and organizational dimension is equally important. Management commitment, communication, supervision, staff competence, procurement policies, and coordination influence how materials are planned, acquired, stored, and utilized. Ineffective managerial practices can create information gaps and coordination failures, resulting in material shortages, duplication of orders, excessive inventory, and waste. The site environment and logistics dimension also affects materials management through site accessibility, space limitations, site layout, transportation arrangements, security, and storage conditions. These factors determine the ease with which materials can be delivered, moved, protected, and accessed during construction. Similarly, contractual and governmental conditions may shape procurement procedures, payment arrangements, regulatory compliance, taxation, importation requirements, and other external conditions that influence the availability and cost of construction materials. The interaction among these factors suggests that effective materials management requires coordinated interventions across the construction supply chain.

Technological development has further expanded the possibilities for improving these processes. Building Information Modelling (BIM), Enterprise Resource Planning (ERP), Radio Frequency Identification (RFID), and other digital technologies can facilitate information sharing, inventory monitoring, procurement planning, material tracking, and coordination among project participants (Yıldız Güneş & Kıvrak, 2024; Ogwueleka, 2025). However, the availability of technology alone does not guarantee effective materials management. Its effectiveness depends on the quality of planning, organizational capability, supplier coordination, managerial commitment, site conditions, logistics, and the institutional environment within which construction firms operate. This reinforces the need to investigate the broader factors that determine materials management effectiveness rather than focusing exclusively on individual management practices or technological solutions.

The Nigerian construction industry operates within a particularly challenging environment characterised by fluctuating material prices, supply uncertainties, transportation constraints, infrastructure deficiencies, unreliable suppliers, and weaknesses in project planning and site management. These conditions can disrupt

material availability and increase the risks of waste, delays, and cost escalation (Adeosun, 2023). Previous empirical studies have associated poor materials handling and management with reduced productivity, increased project costs, and delays (Albert et al., 2021), while Mgbeahuru and Olughu (2022) linked ineffective materials management to construction waste, schedule overruns, quality deficiencies, and poor project performance. Evidence from Anambra State similarly indicates that materials planning, inspection, and coordination can influence construction project delivery (Obinwune, Ngige, & Ikeagu, 2025; Obodoh, Okeke, Mgbeahuru, & Okongwu, 2025). However, the persistence of procurement delays, material losses, inadequate storage, and inefficient coordination suggests that improvements in individual materials management practices may not adequately address the underlying determinants of effectiveness.

This study was anchored on Supply Chain Management Theory, which provides an appropriate basis for understanding materials management as an interconnected process involving multiple actors, activities, resources, and information flows. Supply Chain Management Theory emphasises the coordination and integration of activities from sourcing and procurement through transportation, storage, distribution, and final utilization to achieve efficiency and improved organizational performance. Within construction, materials move through a network involving manufacturers, suppliers, transporters, contractors, consultants, subcontractors, and site personnel. Inefficiency at any point in this network can affect material availability and subsequently influence project cost, time, quality, and productivity.

The theory is particularly relevant because the factors examined in this study extend beyond the physical handling of materials at the construction site. Planning and handling, supplier and manufacturer relationships, management practices, transportation, contractual arrangements, site conditions, and governmental factors represent interconnected components of the construction supply chain. Effective materials management therefore depends on the coordination of these components and the timely exchange of materials, information, and resources among supply-chain participants. The theory provides the conceptual basis for examining how these interconnected factors jointly and individually influence materials management effectiveness.

The application of Supply Chain Management Theory also provides a basis for the study's contribution. Rather than treating materials management as a narrow procurement or storage function, the study conceptualises it as a system of interdependent activities extending from planning and sourcing to delivery, storage, handling, and utilization. This perspective enables the study to identify which factor categories exert the greatest influence on materials management effectiveness and therefore require greater managerial attention.

Statement of the Research Problem

Construction materials represent one of the largest components of project expenditure, accounting for approximately 50% to 70% of total construction project costs (Mahadi & Mizal Azzmi, 2023). Ineffective management of such a substantial cost component can therefore have direct consequences for project cost, time, quality, productivity, and profitability. In practice, however, construction firms continue to encounter material shortages, delayed deliveries, excessive purchasing, material deterioration, wastage, poor storage, inefficient handling, and inadequate inventory control. These problems are particularly problematic where supply chains are fragmented and construction firms operate under uncertain market and infrastructural conditions.

In Nigeria, fluctuating material prices, unreliable suppliers, transportation difficulties, weak logistics infrastructure, and inadequate site management continue to create difficulties for the efficient flow of materials to construction sites (Adeosun, 2023). Albert et al. (2021) found that ineffective materials handling and management can reduce productivity and increase construction costs and delays, while Mgbeahuru and Olughu (2022) identified

ineffective materials management as a contributor to construction waste, schedule overruns, quality problems, and poor project performance. These findings demonstrate that the materials management problem extends beyond the physical availability of materials to include planning, procurement, coordination, transportation, storage, handling, and managerial processes.

The problem is also relevant to Anambra State, where continued residential, commercial, and public construction activity creates substantial demand for construction materials. Although existing studies in the state have reported the importance of materials planning, inspection, and coordination to construction project delivery (Obinwune et al., 2025; Obodoh et al., 2025), there remains limited empirical evidence establishing which factors most strongly determine the effectiveness of materials management and the relative contribution of each factor. Existing research has largely examined materials management practices, individual challenges, construction waste, or the relationship between materials management and project performance. Consequently, construction firms and policymakers have limited empirical evidence for prioritising interventions according to the relative influence of the underlying determinants of materials management effectiveness.

The central problem addressed by this study is therefore the lack of a comprehensive, context-specific empirical understanding of the factors influencing effective materials management among construction firms in Anambra State. Without such evidence, interventions may focus on isolated operational problems without addressing the interconnected factors responsible for persistent inefficiencies. This study addresses the problem by empirically examining the relative influence of planning and handling, supplier and manufacturer, management, site condition, transportation and contractual, and governmental factors on effective materials management practices. The resulting evidence provides a basis for prioritising managerial and supply-chain interventions and contributes to a more integrated understanding of construction materials management in the Nigerian context.

Research Gap and Contribution

The reviewed literature establishes that effective materials management is important for construction project performance and that several operational and supply-chain challenges affect material availability and utilization. However, three important gaps remain. First, previous studies have predominantly examined specific materials management practices or their consequences for project performance, with comparatively less attention to the combined and relative influence of the factors that determine materials management effectiveness. Second, existing studies have not sufficiently integrated organizational, planning, supplier-related, site, transportation, contractual, and governmental dimensions within a single empirical model applicable to construction firms in Anambra State. Third, there is limited quantitative evidence establishing which of these factor categories have the strongest predictive influence on materials management effectiveness.

This study fills these gaps by developing and empirically testing a multidimensional model of factors influencing effective materials management among construction firms in Anambra State. The study goes beyond identifying the existence of materials management challenges by determining their relative predictive influence through Multiple Linear Regression Analysis. Its novelty therefore lies in providing empirical evidence on the hierarchy and predictive strength of the major factor categories within a specific Nigerian construction context. The findings contribute to knowledge by extending the application of Supply Chain Management Theory to construction materials management and demonstrating how interconnected supply-chain, organizational, operational, and institutional factors collectively influence materials management effectiveness. In practice, the findings provide construction firms and industry stakeholders with an evidence-based basis for prioritising interventions in areas with the greatest influence on materials management performance.

Aim of the Study

The aim of this study is to assess the factors affecting effective materials management practices among construction firms in Anambra State, Nigeria, and determine their relative influence on materials management effectiveness.

Specific Objectives

The study seeks to:

1. identify the major factors affecting effective materials management practices among construction firms in Anambra State, Nigeria;
2. assess the influence of planning and handling factors on effective materials management practices among construction firms in Anambra State;
3. determine the influence of supplier and manufacturer factors on effective materials management practices among construction firms in Anambra State;
4. examine the influence of management and organizational factors on effective materials management practices among construction firms in Anambra State;
5. determine the influence of site condition, transportation, and contractual factors on effective materials management practices among construction firms in Anambra State; and
6. assess the influence of governmental and regulatory factors on effective materials management practices among construction firms in Anambra State.

Research Questions

The following research questions guide the study:

1. What are the major factors affecting effective materials management practices among construction firms in Anambra State, Nigeria?
2. To what extent do planning and handling factors influence effective materials management practices among construction firms in Anambra State?
3. To what extent do supplier and manufacturer factors influence effective materials management practices among construction firms in Anambra State?
4. To what extent do management and organizational factors influence effective materials management practices among construction firms in Anambra State?
5. To what extent do site condition, transportation, and contractual factors influence effective materials management practices among construction firms in Anambra State?
6. To what extent do governmental and regulatory factors influence effective materials management practices among construction firms in Anambra State?

Research Hypotheses

The following null hypothesis are formulated and was tested at the 0.05 level of significance:

H_0: There are no significant factors affecting effective materials management practices in construction firms in Anambra State.

II. LITERATURE REVIEW

A. The Concept of materials management

Construction materials management refers to the systematic coordination of activities involved in planning, sourcing, procuring, transporting, receiving, storing, handling, controlling, and utilizing materials required for construction project execution. The concept extends beyond the purchasing of materials to encompass the entire flow of materials and associated information from suppliers to the construction site and ultimately to their point of use. Chitkara (1998) conceptualised materials management as a coordinated process for ensuring the efficient flow and utilization of materials while controlling cost and waste. Similarly, Abdul-Rahman, Wang, and Yap (2013) viewed materials management as an integrated process connecting supply activities with construction-site operations.

The importance of materials management derives largely from the substantial financial and operational role of materials in construction. Construction materials constitute a major

component of project expenditure, and deficiencies in their planning, procurement, storage, and utilization can directly affect project cost, schedule, quality, and productivity. Recent empirical evidence confirms this relationship. For example, a study of Nigerian construction projects by Albert, Shakantu, and Ibrahim (2021) found that poor materials management was associated with material waste, poor quality of work, poor material flow, project delays, and reduced profitability. Similarly, research on Nigerian building construction has identified materials planning, logistics, and procurement as important dimensions of materials management and demonstrated their implications for construction project performance.

Materials management is therefore multidimensional. Its major functions include materials planning, procurement, supplier coordination, transportation, receiving, inspection, storage, inventory control, handling, and waste management. These functions are interdependent, meaning that weakness in one activity can create problems in other stages of the materials flow. For example, inaccurate planning can result in over-ordering or shortages, while unreliable suppliers can undermine otherwise effective procurement plans. Poor transportation and site accessibility can delay deliveries, while inadequate storage can result in deterioration, theft, or damage. This interdependence supports the treatment of materials management as a supply-chain process rather than a collection of independent site activities.

Recent empirical research further supports this multidimensional perspective. A 2024 study examining materials management and project performance found that material supply, handling, stock control, and waste control had significant positive effects on project performance, although material planning and logistics did not demonstrate statistically significant effects in that particular context. This finding is important because it demonstrates that the influence of individual materials management dimensions may differ according to context. It also suggests that identifying the relative influence of different factors is more useful than assuming that all materials management activities contribute equally to effectiveness.

Technological developments have also expanded the scope of materials management. Digital systems such as Building Information Modelling (BIM), Enterprise Resource Planning (ERP), Internet of Things (IoT), and Radio Frequency Identification (RFID) can improve material tracking, inventory visibility, procurement coordination, and information sharing. For instance, RFID-based materials management systems have been shown to provide real-time information on material location and order status, with potential benefits for cost and time control. However, technological tools are only one component of an effective materials management system. Their benefits depend on organizational capability, planning quality, supplier coordination, logistics, management commitment, and the wider institutional environment.

Consequently, this study defines effective materials management as the extent to which construction firms successfully coordinate the planning, procurement, supply, transportation, storage, handling, inventory control, and utilization of construction materials to ensure their availability in the required quantity, quality, condition, location, and time while minimizing waste and unnecessary cost.

B. Concept of Effectiveness in Construction Materials Management

Effectiveness refers to the extent to which intended objectives are achieved. In construction

management, effectiveness is commonly reflected in the ability of project participants to achieve desired cost, time, quality, productivity, and resource-utilization outcomes. Effectiveness differs from efficiency in that effectiveness is concerned primarily with achieving the intended outcomes, whereas efficiency concerns the optimal use of resources in achieving those outcomes.

In materials management, effectiveness is reflected in the ability of a construction firm to make the required materials available when and where they are needed, in the appropriate quantity and quality, while controlling waste, cost, damage, deterioration, and unnecessary inventory. This perspective is consistent with Koskela's (2000) Transformation-Flow-Value view of construction, which argues that construction performance depends not only on transforming inputs into outputs but also on ensuring smooth and reliable flows and creating value for project stakeholders.

Lean Construction Theory also provides a useful explanation of materials management effectiveness. Ballard and Howell (2003) emphasised the importance of reliable workflow and the reduction of variability in construction operations. From this perspective, material shortages, late deliveries, unnecessary movement, excessive inventory, defects, and waiting represent forms of process variability and waste. Effective materials management therefore contributes to construction effectiveness by reducing interruptions and supporting predictable workflow.

Empirical research provides support for this relationship. Albert et al. (2021) reported that poor materials management in Nigerian construction projects contributes to material waste, poor quality, and reduced project profitability. Similarly, Eze et al. identified inefficient materials management across the construction project value chain as a contributor to poor project performance, particularly in relation to time, cost, quality, and productivity. Recent empirical evidence also shows that material supply, handling, and stock and waste control can significantly affect project performance.

Effectiveness in materials management can therefore be considered an outcome of the interaction between several activities and contextual conditions. Planning and handling determine whether materials are properly anticipated, ordered, received, stored, and used. Supplier and manufacturer factors influence reliability of supply, material quality, delivery time, and availability. Management factors determine the quality of coordination, supervision, communication, and decision-making. Site conditions affect storage, movement, security, and accessibility. Transportation and contractual factors influence the physical and administrative movement of materials, while governmental and regulatory factors can affect procurement procedures, taxation, importation, standards, and market conditions.

This multidimensional understanding provides the basis for examining effective materials management as the dependent construct in this study.

C. Empirical Review of Factors Influencing Materials Management Effectiveness

C.1 Planning and Handling Factors

Planning is a fundamental component of construction materials management because it determines the type, quantity, quality, timing, and location of materials required for project execution. Effective materials planning involves forecasting material requirements, preparing procurement schedules, coordinating deliveries with the construction programme, and ensuring

that materials are available when required. Poor planning can result in material shortages, excessive purchases, premature deliveries, deterioration, unnecessary storage, and disruption of construction activities (Chitkara, 2005; Ofori, 2012; Albert et al., 2021). In this regard, materials planning should be closely integrated with project scheduling because changes in construction activities can alter material requirements and delivery priorities.

Empirical studies have established a relationship between planning practices and construction performance. Albert et al. (2021) found that inadequate planning and poor handling of materials contributed to material waste, poor material flow, reduced productivity, and increased project costs in Nigerian construction projects. Similarly, Wahab and Lawal (2019) identified poor planning, inadequate control, and weak coordination as important causes of materials management problems in developing-country construction environments. Saidu and Shakantu (2016) also reported that deficiencies in materials management contributed to material waste and cost escalation, demonstrating the financial implications of ineffective planning and control.

Handling is another important dimension because materials must be moved from delivery points to storage areas and subsequently to their points of use. Inefficient handling can result in breakage, deterioration, loss, contamination, excessive movement, and additional labour requirements (Chitkara, 2005; Albert et al., 2021). Formoso, Soibelman, De Cesare, and Isatto (2002) observed that unnecessary movement and poor control of materials constitute forms of waste that can reduce construction productivity. From a lean construction perspective, Ballard and Howell (2003) similarly argued that construction performance improves when workflow variability and unnecessary activities are reduced.

Recent research has reinforced the importance of material handling and stock control. A recent empirical study found that material handling and stock and waste control had significant relationships with project performance, indicating that the way materials are received, stored, controlled, and utilized can influence construction outcomes (Agyekum et al., 2024). Digital technologies have also been identified as mechanisms for improving these processes. Yıldız Güneş and Kıvrak (2024) noted that digital approaches can improve information availability and coordination in construction supply chains, while Ogwueleka (2025) highlighted the potential of digital systems for improving materials and resource management.

The evidence suggests that planning and handling are closely interconnected. Accurate planning establishes what materials are required and when they are needed, while effective handling ensures that materials are delivered, stored, moved, and utilized without unnecessary loss or damage (Ofori, 2012; Albert et al., 2021). However, the relative influence of planning and handling factors may vary across construction environments. This study therefore examines planning and handling factors empirically to determine their extent of influence on effective materials management among construction firms in Anambra State.

C.2 Supplier and Manufacturer Factors

Construction materials management is strongly dependent on the performance of suppliers and manufacturers because contractors often rely on external organizations for the production, availability, quality, and delivery of materials. Supplier-related factors include reliability, product quality, delivery time, price stability, communication, responsiveness, production capacity, and adherence to specifications (Ofori-Kuragu et al., 2021; Albert et al., 2021). When

suppliers fail to meet agreed delivery schedules or supply materials that do not conform to specifications, construction activities can be interrupted and additional procurement costs may arise.

Supply-chain coordination is particularly important because construction projects involve multiple independent organizations whose activities must be synchronized. Vrijhoef and Koskela (2000) argued that construction supply-chain problems often originate from fragmentation and inadequate coordination between participants. Similarly, Ofori-Kuragu et al. (2021) emphasised that effective supply-chain integration is necessary for improving the flow of materials and information within construction projects. Weak coordination can produce information delays, incorrect orders, late deliveries, material shortages, and excessive inventory.

Empirical evidence from construction projects indicates that supplier performance can influence project outcomes through material availability and reliability. Albert et al. (2021) reported that poor material supply and handling contributed to disruptions in construction operations and reduced project performance. Studies of construction supply chains have likewise identified supplier reliability, lead time, quality, and coordination as important determinants of effective material flow (Ofori-Kuragu et al., 2021; Agyekum et al., 2024). Where contractors maintain reliable relationships with suppliers, they are better positioned to coordinate deliveries, respond to changes in project requirements, and reduce procurement uncertainty.

The importance of supplier coordination has become even more pronounced in environments characterised by price volatility and supply uncertainty. Adeosun (2023) noted that Nigerian construction firms face challenges associated with fluctuating material prices, unreliable suppliers, and logistics constraints. Such conditions can make procurement planning difficult and increase the likelihood of material shortages or cost escalation. Consequently, supplier and manufacturer factors represent an important external determinant of materials management effectiveness.

Nevertheless, supplier-related challenges cannot be considered independently of internal management practices. Effective supplier relationships require clear specifications, timely communication, accurate orders, prompt payments, and competent procurement management (Ofori-Kuragu et al., 2021). This suggests that supplier performance is partly dependent on the quality of coordination between construction firms and their supply-chain partners. The present study therefore examines supplier and manufacturer factors as an independent category influencing effective materials management.

C.3 Management and Organisational Factors

Management and organisational factors determine how materials management responsibilities are planned, coordinated, monitored, and controlled within construction firms. These factors include management commitment, staff competence, communication, supervision, procurement policies, delegation of responsibilities, documentation, inventory procedures, and coordination among project participants (Chitkara, 2005; Ofori, 2012). Effective organisational structures enable materials-related information to move efficiently between procurement personnel, quantity surveyors, project managers, site engineers, suppliers, and other stakeholders.

Poor management can create coordination failures that directly affect material availability and utilization. Albert et al. (2021) identified

inadequate materials management practices as a contributor to poor material flow, waste, delays, and reduced productivity in Nigerian construction projects. Wahab and Lawal (2019) similarly reported that weak management systems, inadequate planning, and poor coordination contribute to materials management difficulties in developing construction environments. These findings indicate that material problems may originate not from physical shortages alone but from weaknesses in organizational decision-making and control.

Communication is particularly important because materials management requires continuous exchange of information concerning quantities, specifications, delivery dates, inventory levels, changes in design, and work schedules. Love, Edwards, and Irani (2004) argued that poor communication and coordination can increase the likelihood of rework and process disruptions. In materials management, such communication failures may result in duplicate orders, incorrect materials, late procurement, and excessive inventory.

Management commitment also influences the adoption of effective materials management systems. Senior management determines the resources available for procurement systems, inventory control, staff training, digital technologies, and logistics coordination. Ogwueleka (2025) observed that digital technologies can improve construction resource management, but their successful implementation depends on organizational readiness and management support. Yıldız Güneş and Kıvrak (2024) similarly emphasized the role of information integration and organizational coordination in improving construction processes.

The empirical evidence therefore indicates that management and organizational capacity provides an important foundation for effective materials management. A construction firm may have reliable suppliers and adequate transportation facilities, but weak internal coordination can still result in poor material utilization. This study consequently examines management and organizational factors to determine their predictive influence on materials management effectiveness.

C.4 Site Condition Factors

Site conditions influence materials management because construction materials must be delivered, unloaded, stored, protected, moved, and utilized within a physical environment that may change throughout project execution. Relevant site factors include accessibility, site layout, available storage space, security, congestion, environmental exposure, location of storage areas, and proximity of materials to points of use (Chitkara, 2005; Formoso et al., 2002).

Inadequate storage space can lead to improper stacking, material damage, obstruction of access routes, and increased handling. Similarly, poor site layout can create unnecessary movement between storage areas and work locations. Formoso et al. (2002) identified unnecessary movement, waiting, and poor material flow as important forms of construction waste. These problems can reduce labour productivity and increase the time and cost associated with material handling.

Site accessibility is also important because restricted access can delay deliveries and make it difficult for suppliers to discharge materials at appropriate locations. Urban construction sites are particularly susceptible to these problems because of limited space, traffic restrictions, neighbouring buildings, and competing demands for access. Adeosun (2023) noted that transportation and infrastructure constraints remain important challenges affecting construction operations in Nigeria.

Security and environmental exposure represent additional site-related concerns. Materials stored in inadequately secured locations may be exposed to theft, vandalism, damage, or deterioration. Materials such as cement, reinforcement, timber, finishes, and electrical components require different storage conditions, and failure to provide appropriate protection can lead to material losses and quality problems (Saidu & Shakantu, 2016; Albert et al., 2021).

The literature therefore suggests that the physical site environment can either facilitate or constrain materials management. Effective site layout, adequate storage, accessibility, security, and proper material positioning can reduce unnecessary movement and losses, while poor site conditions can increase material waste and handling requirements (Formoso et al., 2002; Albert et al., 2021). This study consequently examines site condition factors as potential determinants of effective materials management among construction firms in Anambra State.

C.5 Transportation and Contractual Factors

Transportation represents a critical connection between suppliers and construction sites. Construction materials must be transported at appropriate times and in suitable conditions to avoid delays, damage, deterioration, and unnecessary storage. Transportation factors include vehicle availability, transportation cost, road conditions, delivery distance, traffic conditions, scheduling, vehicle reliability, and coordination between suppliers and contractors (Ofori-Kuragu et al., 2021; Adeosun, 2023).

Transportation problems can have direct implications for project scheduling. Late delivery of critical materials may interrupt work activities, leave labour and equipment idle, and cause delays to subsequent activities. Conversely, premature delivery may increase storage requirements and expose materials to deterioration or theft (Chitkara, 2005; Formoso et al., 2002). This creates a need to coordinate transportation schedules with procurement plans and construction programmes.

The Nigerian construction environment presents additional transportation challenges because poor road infrastructure, traffic congestion, rising fuel costs, and long supply distances can increase delivery uncertainty (Adeosun, 2023). Ofori-Kuragu et al. (2021) similarly emphasised the importance of logistics coordination in achieving efficient material flow within construction supply chains.

Contractual arrangements also influence materials management because contracts define responsibilities for procurement, specifications, delivery, inspection, payment, risk allocation, and material ownership. Poorly defined responsibilities can create uncertainty concerning who is responsible for ordering, transporting, receiving, inspecting, or storing materials. Delayed payments may also affect supplier willingness to deliver materials, particularly where suppliers operate under tight cash-flow conditions.

From a supply-chain perspective, contractual coordination is important because construction materials pass through several organizational boundaries. Vrijhoef and Koskela (2000) argued that fragmentation among construction supply-chain participants can create inefficiencies when responsibilities and activities are poorly coordinated. Consequently, transportation and contractual arrangements can influence the reliability of material flow and the effectiveness of materials management.

C.6 Governmental and Regulatory Factors

Governmental and regulatory factors constitute the broader institutional environment within

which construction materials are procured and utilized. These factors include taxation, import duties, customs requirements, material standards, environmental regulations, procurement regulations, transportation policies, building regulations, and other government interventions that affect construction material availability and cost.

The Nigerian construction industry is particularly sensitive to changes in the external economic and regulatory environment. Fluctuations in material prices, exchange rates, import restrictions, transportation regulations, and taxation can affect procurement costs and material availability (Adeosun, 2023). Where construction firms depend on imported materials or materials whose prices are linked to international markets, changes in government policy can introduce considerable uncertainty into procurement planning.

Regulatory requirements can also influence the selection and procurement of construction materials. Compliance with standards and specifications is essential for ensuring material quality, but changes in standards or approval requirements can increase procurement lead times and costs. Ofori-Kuragu et al. (2021) emphasised the importance of coordination across construction supply chains, while Adeosun (2023) highlighted the wider economic and infrastructural conditions affecting construction materials in Nigeria.

Although governmental factors may be less directly controllable by construction firms than internal management practices, their effects can be substantial. This is particularly relevant where policy changes affect material prices, transportation costs, importation, or procurement procedures. The present study therefore considers governmental and regulatory factors as part of the broader determinants of effective materials management.

D. Theoretical Review

D.1 Supply Chain Management Theory

Supply Chain Management Theory provides the principal theoretical foundation for this study because construction materials management involves the coordinated movement of materials, information, finances, and responsibilities across multiple organizations and activities. Supply chain management is concerned with the integration and coordination of activities from sourcing and procurement through production, transportation, distribution, and final utilization to improve organizational and supply-chain performance (Christopher, 2016; Mentzer et al., 2001).

Mentzer et al. (2001) conceptualised supply chain management as the systemic and strategic coordination of traditional business functions and tactics across organizations within the supply chain. This perspective is particularly applicable to construction because material procurement does not occur within the boundaries of a single contractor. Instead, it involves manufacturers, suppliers, transporters, contractors, consultants, subcontractors, project managers, and regulatory institutions. Christopher (2016) similarly emphasised that effective supply-chain management depends on coordinating relationships, information, resources, and processes across organizational boundaries.

The construction industry presents a particularly complex supply-chain environment because projects are temporary, geographically dispersed, project-specific, and characterized by fragmented organizational relationships. Vrijhoef and Koskela (2000) argued that construction supply chains require improved coordination because inefficiencies in upstream activities can create problems downstream at the construction site. Poor coordination can result in

material shortages, excessive inventory, delayed deliveries, unnecessary handling, and increased waste.

The relevance of Supply Chain Management Theory to materials management is evident in the interdependence of materials-related activities. Planning determines the quantity and timing of materials required; procurement establishes relationships with suppliers; manufacturers determine production and material availability; transportation facilitates physical movement; site conditions determine storage and accessibility; management coordinates organizational decisions; contractual arrangements establish responsibilities; and government regulations shape the wider operating environment. These activities cannot be managed effectively in isolation because decisions at one stage influence outcomes at other stages (Christopher, 2016; Ofori-Kuragu et al., 2021).

Supply Chain Management Theory also provides a basis for understanding the role of information. Accurate and timely information regarding material requirements, inventory levels, supplier capacity, delivery schedules, prices, specifications, and project progress is essential for effective coordination. Information deficiencies can result in inaccurate forecasts, delayed procurement, duplicate orders, and poor inventory control (Mentzer et al., 2001; Christopher, 2016). The increasing application of BIM, ERP, RFID, and other digital technologies in construction materials management reflects this growing emphasis on information integration and visibility (Yıldız Güneş & Kıvrak, 2024; Ogwueleka, 2025).

The theory further suggests that supply-chain performance depends on relationships among participants. Supplier reliability, trust, communication, coordination, and information sharing can influence the efficiency of material flows (Mentzer et al., 2001; Vrijhoef & Koskela, 2000). In construction, where firms frequently work through temporary project networks, the ability to establish effective coordination mechanisms is particularly important. Weak supplier relationships can result in poor delivery reliability, inconsistent quality, and procurement uncertainty, while effective relationships can facilitate timely delivery and improved responsiveness.

D.2 Application of Supply Chain Management Theory to the Study

Supply Chain Management Theory provides a logical explanation for the six categories of factors investigated in this study. Planning and handling factors represent internal activities that initiate and control the physical flow of materials. Effective planning ensures that material requirements are identified in advance, while effective handling ensures that materials move through the site with minimal damage and unnecessary movement (Chitkara, 2005; Albert et al., 2021).

Supplier and manufacturer factors represent upstream supply-chain relationships. Supplier reliability, product quality, delivery performance, and communication directly influence the availability of materials to construction projects (Ofori-Kuragu et al., 2021; Christopher, 2016). Management and organizational factors represent the firm's internal capability to coordinate these relationships and integrate materials-related decisions with project activities (Mentzer et al., 2001; Ofori, 2012).

Site condition factors represent the physical environment through which material flows are received, stored, moved, and utilized. Although site conditions are internal to the project, they interact with upstream supply-chain activities because delivery schedules, storage capacity, and material handling arrangements must be

coordinated with the physical characteristics of the site (Formoso et al., 2002; Albert et al., 2021).

Transportation and contractual factors represent the logistical and relational mechanisms that connect different participants in the construction supply chain. Transportation facilitates physical material flow, while contracts establish responsibilities, obligations, payment conditions, specifications, and risk allocation among participants (Vrijhoef & Koskela, 2000; Christopher, 2016).

Finally, governmental and regulatory factors represent the external institutional environment within which the construction supply chain operates. Taxation, importation requirements, standards, transportation regulations, and other government policies can influence material cost, availability, procurement procedures, and delivery conditions (Adeosun, 2023). Supply Chain Management Theory therefore accommodates both controllable internal factors and external factors that influence the performance of the construction materials supply chain.

The theory consequently supports the proposition that effective materials management results from the coordinated functioning of interconnected activities rather than from procurement or storage alone. This theoretical position is consistent with empirical evidence showing that materials supply, handling, stock control, logistics, and waste management can influence construction project performance (Albert et al., 2021; Agyekum et al., 2024). It also supports the use of a multivariate analytical approach because the different factors may simultaneously influence materials management effectiveness and may vary in their relative predictive strength.

D.3 Theoretical Implication for the Present Study

The application of Supply Chain Management Theory enables the study to move beyond a narrow conceptualisation of materials management as a site-level function. Instead, materials management is treated as an integrated supply-chain activity extending from planning and sourcing to procurement, manufacturing, transportation, delivery, storage, handling, and utilization. This theoretical position provides the basis for examining the simultaneous contribution of internal, supplier-related, logistical, site, contractual, and governmental factors.

The theory also provides the conceptual justification for testing both the individual and joint influence of the identified factors. If construction materials management is a product of interconnected supply-chain activities, then weaknesses in several parts of the chain may collectively explain variations in effectiveness. Multiple Linear Regression Analysis is therefore appropriate for determining the relative predictive contribution of each factor category while also assessing their combined explanatory power.

The theoretical position adopted in this study is thus that effective materials management is a function of the degree to which material-related activities and relationships are planned, integrated, coordinated, and controlled across the construction supply chain. This proposition forms the theoretical foundation for the conceptual framework and empirical model developed in the study.

E. Conceptual Framework

Based on the reviewed literature and Supply Chain Management Theory, this study conceptualises effective materials management as an outcome of six major categories of factors.

The framework assumes that the effectiveness of materials management is influenced by the quality of planning and handling, supplier and manufacturer performance, management and organizational practices, site conditions, transportation and contractual arrangements, and governmental and regulatory conditions.

The conceptual relationship is presented as follows:

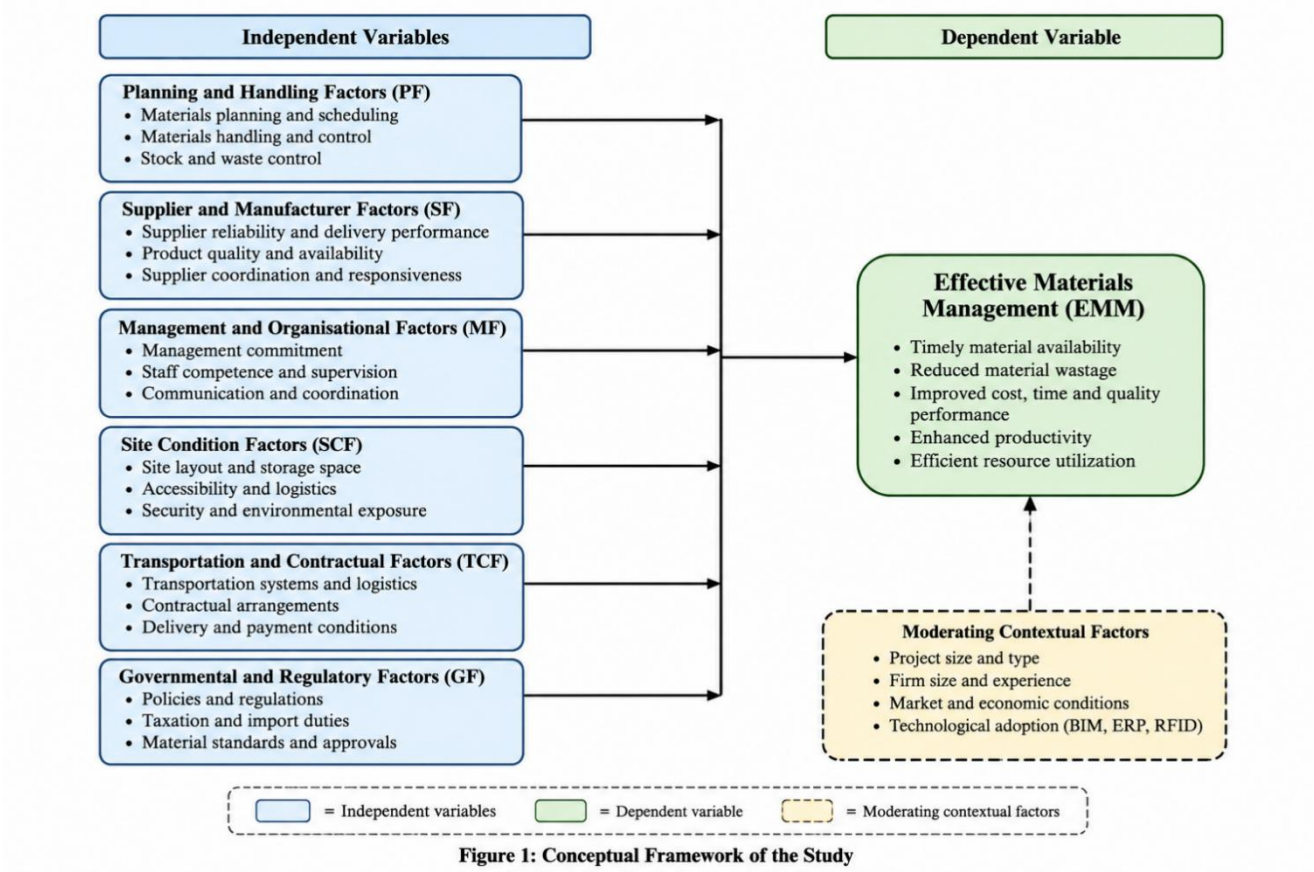


Figure 1: Conceptual Framework of Factors Influencing Effective Materials Management
Source: Author's conceptualisation based on the reviewed literature, (2026).

The framework proposes that each independent-variable category may individually influence materials management effectiveness, while their combined effect may provide a stronger explanation of variations in materials management practices. This proposition is empirically testable through Multiple Linear Regression Analysis.

The framework also reflects the supply-chain orientation of the study. Planning and handling represent internal operational processes; supplier and manufacturer factors represent upstream relationships; management factors capture organizational capability; transportation and contractual factors represent logistics and formal coordination mechanisms; site conditions represent the physical operating environment; and governmental factors represent the wider institutional environment. The dependent variable, effective materials management, captures the ability of construction firms to coordinate these activities to achieve reliable material availability, control waste and cost, and support uninterrupted construction operations.

III. METHODOLOGY

The study adopted a descriptive survey research design to examine the factors affecting effective materials management practices among construction firms in Anambra State, Nigeria. The study population comprised 491 registered construction firms obtained from the Anambra State Bureau of Public Procurement (ANSBPP). Firms were eligible for inclusion where they

were registered and actively undertaking construction activities in Anambra State and had personnel directly involved in materials planning, procurement, storage, handling, transportation, or control. Firms that were inactive, not engaged in construction activities during the study period, or had no personnel with direct responsibility for materials management were excluded. Respondents were drawn from project managers, site engineers, quantity surveyors, procurement officers, materials managers, and site supervisors.

Using the Taro Yamane formula at a 5% level of precision, a sample size of 220 respondents was obtained. A multi-stage sampling procedure was adopted. Purposive sampling was first used to identify active construction firms, proportionate stratified sampling was subsequently applied to ensure representation across the selected categories of firms, while simple random sampling was used to select eligible respondents within the participating firms. Of the 220 questionnaires administered, 211 were returned, representing a 95.9% retrieval rate. After screening for completeness and consistency, 205 questionnaires were retained for analysis, representing a usable response rate of 93.2%.

The questionnaire was developed from themes and variables identified from previous empirical studies on construction materials management. Items were adapted and reworded to reflect the operational conditions of construction firms in Anambra State. The instrument consisted of sections covering respondents' characteristics, factors affecting materials management, and the effectiveness of materials management practices. The factors examined were site condition, planning and handling, management, materials, suppliers and manufacturers, transportation, contractual, and governmental factors. Each factor was measured using relevant indicators presented in Table 1, while responses were obtained on a five-point Likert scale ranging from 5 = Strongly Agree to 1 = Strongly Disagree.

Content and face validity were established through expert assessment by five academics and construction professionals with experience in construction management, materials management, and research methodology. The experts examined the questionnaire for relevance, clarity, adequacy of coverage, and consistency with the study objectives. Items considered ambiguous or repetitive were reworded or removed, while additional items suggested by the experts were incorporated. A pilot test involving 22 respondents from construction firms outside the study area was subsequently conducted. The proposed reliability assessment produced Cronbach's Alpha coefficients of 0.82 for site condition factors, 0.86 for planning and handling factors, 0.84 for management factors, 0.81 for materials factors, 0.85 for suppliers and manufacturers' factors, 0.79 for transportation factors, 0.83 for contractual factors, 0.78 for governmental factors, and 0.88 for the overall instrument. These coefficients exceeded the 0.70 threshold and indicated satisfactory internal consistency.

Ethical principles were observed throughout the study. Participation was voluntary, respondents were informed of the purpose of the study, and informed consent was obtained before questionnaire administration. Respondents were not required to provide personally identifying information, and the information obtained was treated confidentially and used strictly for academic purposes. Participation or withdrawal from the study did not attract any penalty or disadvantage.

The collected data were coded and analysed using SPSS. Frequencies, percentages, means, and standard deviations were used for descriptive analysis. A mean benchmark of 3.00 was adopted for interpreting the five-point Likert

scale, with mean scores of 3.00 and above indicating agreement that the factor affects effective materials management. The group mean was calculated for each factor category to establish its relative importance, while ranking was used to determine the order of influence of individual factors. Multiple Linear Regression Analysis was employed to determine the combined and relative influence of the eight factor categories on effective materials management practices. The dependent variable was effective materials management, while site condition, planning and handling, management, materials, suppliers and manufacturers, transportation, contractual, and governmental factors constituted the independent variables. The hypotheses were tested at the 5% level of significance.

Before regression analysis, the major assumptions of multiple linear regression were examined. Normality was assessed using skewness and kurtosis statistics and normal probability plots, with the observed values falling within acceptable limits. Linearity was assessed using scatterplots of the dependent variable against the predictor variables and was considered satisfactory. Multicollinearity was assessed using tolerance and Variance Inflation Factor (VIF) statistics. The proposed results showed tolerance values ranging from 0.421 to 0.706 and VIF values ranging from 1.416 to 2.375, indicating the absence of problematic multicollinearity. Homoscedasticity was assessed through the residual-versus-predicted-value plot, which showed a relatively random distribution of residuals around zero. Independence of errors was assessed using the Durbin-Watson statistic, which produced a value of 1.91, indicating acceptable independence of residuals. These results confirmed the suitability of the dataset for multiple linear regression analysis.

IV. RESULTS AND DISCUSSION

Table 1: Showing the Mean Scores of the Respondents on the Factors Affecting Effective Materials Management Practices in Construction Firms

S/N	Factor	Mean	SD	95% CI for Mean	Rank
1	Planning and Handling Factors	4.32	0.58	4.24–4.40	1st
2	Site Condition Factors	4.18	0.63	4.09–4.27	2nd
3	Management Factors	4.12	0.61	4.04–4.20	3rd
4	Suppliers and Manufacturers' Factors	4.10	0.64	4.01–4.19	4th
5	Contractual Factors	4.08	0.65	3.99–4.17	5th
6	Materials Factors	4.06	0.67	3.97–4.15	6th
7	Transportation Factors	4.02	0.69	3.92–4.12	7th
8	Governmental Factors	3.98	0.71	3.88–4.08	8th

Source: Researcher's Field survey (2024)

Table 1 indicates that all eight categories recorded mean scores above the criterion mean of 3.00, demonstrating that respondents perceived each category as an important determinant of effective materials management. Planning and handling factors recorded the highest mean score (M = 4.32, SD = 0.58), followed by site condition factors (M = 4.18, SD = 0.63) and management factors (M = 4.12, SD = 0.61). Governmental factors had the lowest

mean score (M = 3.98, SD = 0.71), although the result remained substantially above the acceptance criterion.

The relatively low standard deviations, ranging from 0.58 to 0.71, indicate reasonable consistency in respondents' perceptions. The narrow confidence intervals further suggest that the estimated mean scores are reasonably stable within the study sample. The results therefore suggest that materials management problems are not attributable to a single isolated factor but arise from the interaction of planning, operational, managerial, supply-chain, contractual, transportation and regulatory conditions.

H_0: There are no significant factors affecting effective materials management practices in construction firms in Anambra State.

To test this hypothesis, Multiple Linear Regression Analysis was performed using the eight identified factor categories as independent variables and the effectiveness of materials management practices as the dependent variable. The regression model summary is presented in Table 2, while the ANOVA and regression coefficients are presented in Tables 3 and 4, respectively.

Table 2: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of Estimate	F	p-value
1	0.882	0.778	0.769	0.210	110.42	<0.001

The regression results show a strong relationship between the eight identified factors and effective materials management practices (R = 0.882). The coefficient of determination (R^2 = 0.778) indicates that the predictors jointly explained 77.8% of the variance in effective materials management practices, while the remaining 22.2% may be attributed to factors outside the model and random variation. The adjusted R^2 of 0.769 confirms that the explanatory power of the model remains high after adjustment for the number of predictors.

The model was statistically significant, $F(8,196) = 110.42$, $p < 0.001$. Thus, the null hypothesis that the identified factors do not significantly influence effective materials management practices is rejected. The model's overall effect size can also be expressed using Cohen's f^2:

$f^2 = R^2 / (1 - R^2) = 0.778 / 0.222 = 3.50$.

This represents a very large overall effect, indicating that the combined predictors have substantial practical as well as statistical importance in explaining materials management effectiveness.

Table 3: Regression Coefficients, Confidence Intervals and Effect Interpretation

Predictor	β	t	p	95% CI for β	Relative Influence
Planning and Handling Factors	0.214	4.88	<0.001	0.128–0.300	1st
Suppliers and Manufacturers' Factors	0.198	4.35	<0.001	0.108–0.288	2nd
Management Factors	0.178	3.91	<0.001	0.088–0.268	3rd
Site Condition Factors	0.162	3.42	0.001	0.069–0.255	4th
Contractual Factors	0.154	3.22	0.001	0.060–0.248	5th
Materials Factors	0.145	3.10	0.002	0.053–0.237	6th
Transportation Factors	0.131	2.88	0.004	0.041–0.221	7th
Governmental Factors	0.122	2.75	0.006	0.035–0.209	8th

Table 3 demonstrates that all eight predictors made statistically significant positive contributions to effective materials management practices. Planning and handling factors produced the largest standardized regression coefficient ($\beta = 0.214$, $p < 0.001$), indicating that they exerted the strongest predictive influence when the effects of the other variables were statistically controlled. Suppliers and manufacturers' factors followed ($\beta = 0.198$, $p < 0.001$), while management factors ranked third ($\beta = 0.178$, $p < 0.001$).

The practical meaning of the standardized coefficients is important. The β coefficient does not mean that a one-unit increase in the original Likert score necessarily produces the stated change in the outcome. Rather, it indicates the relative strength of each predictor in standard-deviation terms while holding the other predictors constant. Thus, the larger coefficient for planning and handling suggests that improvements in materials planning, handling procedures, protective measures, unloading arrangements and coordination of material flows are likely to produce comparatively greater improvements in materials management effectiveness than equivalent improvements in the lower-ranked predictors.

The result for suppliers and manufacturers' factors (β = 0.198) demonstrates the importance of reliable external supply relationships. Delayed deliveries, supplier errors, manufacturing delays and limited availability of competent suppliers can interrupt material availability and consequently disrupt construction operations. The relatively high coefficient therefore suggests that construction firms should treat supplier selection, supplier evaluation and delivery reliability as strategic materials management concerns rather than merely procurement activities.

Management factors also demonstrated a substantial positive influence (β = 0.178). This implies that financial control, supervision, communication, ordering accuracy, documentation and internal control systems are important organizational mechanisms through which effective materials management is achieved. The finding reinforces the proposition of the Resource-Based View, which considers managerial capabilities, organizational routines and knowledge-based resources as important sources of improved organizational performance.

Site condition factors recorded β = 0.162 (p = 0.001), showing that physical site conditions remain an important determinant of material-flow effectiveness. Inadequate storage areas, restricted movement, congestion and long transportation distances within construction sites can increase handling time and material losses. The finding suggests that materials management cannot be separated from site planning and site logistics.

Contractual factors (β = 0.154), materials factors (β = 0.145), transportation factors (β = 0.131) and governmental factors (β = 0.122) also had significant positive coefficients. Although their relative coefficients were smaller, their statistically significant effects demonstrate that they remain relevant components of an integrated materials management system. The practical implication is that construction firms should not concentrate exclusively on procurement and inventory activities while neglecting contractual clarity, material quality, transportation arrangements and regulatory conditions.

Discussion of Findings

The findings demonstrate that effective materials management among construction firms in Anambra State is influenced by a combination of interconnected operational, organizational and external factors. All eight factor categories recorded mean scores above the criterion mean of 3.00, while the multiple regression model explained 77.8% of the variance in materials management effectiveness. This high explanatory power indicates that materials management is a multidimensional function in which internal management capabilities interact with site conditions, suppliers, transportation systems, contractual arrangements and governmental conditions.

Planning and handling factors emerged as the most highly rated category (M = 4.32) and also produced the largest standardized regression coefficient (β = 0.214). The convergence of the descriptive and inferential findings is particularly important because it indicates that planning and handling are not merely perceived by respondents as important; they also make the strongest relative contribution to predicting materials management effectiveness. This can be explained by the sequential nature of construction material flows. Materials must be identified, quantified, ordered, delivered, received, inspected, stored, handled and issued at appropriate stages of construction. Failure at any stage can create shortages, excess inventory,

damage, waiting time and additional handling. From a Lean Construction perspective, ineffective planning introduces variability and non-value-adding activities into the production process, while effective planning promotes reliable material flow and reduces waste.

Suppliers and manufacturers' factors ranked second in the regression analysis ($\beta = 0.198$, $p < 0.001$). This finding highlights the fact that construction firms do not have complete control over their materials supply systems. The effectiveness of internal materials management depends partly on the reliability of external suppliers and manufacturers. Delayed deliveries, supplier errors, manufacturing interruptions and inadequate supplier capacity can create material shortages even where a contractor has adequate internal planning systems. The finding therefore supports the logic of Supply Chain Management Theory, which views organizational performance as partly dependent on coordination and integration among interconnected supply-chain actors. In practical terms, construction firms should develop supplier prequalification systems, monitor supplier performance and establish reliable communication and delivery schedules.

Management factors recorded the third-highest standardized coefficient ($\beta = 0.178$, $p < 0.001$). This suggests that materials management effectiveness is strongly influenced by organizational capabilities rather than physical materials alone. Financial constraints, ordering errors, communication problems, inadequate supervision, weak control systems and documentation errors can compromise the movement and utilization of materials. This finding is consistent with the Resource-Based View, because organizational routines, managerial competence, information systems and coordination capabilities constitute resources that can improve operational performance. The implication is that investment in materials management should extend beyond physical storage facilities to include staff competence, managerial systems, digital tracking and effective internal communication.

Site condition factors also demonstrated a significant influence ($\beta = 0.162$, $p = 0.001$). The high mean score ($M = 4.18$) indicates that respondents considered inadequate storage space, restricted equipment movement, poor storage conditions, improper stacking, congestion and long material movement distances important problems. This result can be explained by the spatial constraints characteristic of many construction sites. When materials are stored far from their point of use or placed in congested areas, workers and equipment require additional time to move them. This increases handling activities, creates opportunities for damage and may contribute to material wastage. Consequently, materials management should be integrated into site layout planning rather than treated as a separate procurement function.

Contractual factors recorded a significant positive coefficient ($\beta = 0.154$, $p = 0.001$). The finding indicates that specification errors, changes in specifications and unclear contractual requirements can affect procurement and material utilization. Changes in specifications after procurement may result in materials becoming unsuitable, while unclear specifications can lead to incorrect purchasing decisions. The practical implication is that project teams should establish stronger coordination between design, procurement and site management functions before materials are ordered.

Materials factors produced $\beta = 0.145$ ($p = 0.002$), indicating that material quality, price fluctuations, shortages, damage, packaging, labelling and demand variability contribute significantly to materials management effectiveness. The result suggests that materials management involves not only ensuring that materials arrive on site but also ensuring that they are of the required quality, adequately protected, properly identified and available when required. Construction firms therefore need effective inspection, inventory classification, labelling and stock-monitoring procedures.

Transportation factors recorded $\beta = 0.131$ ($p = 0.004$). Although this was the second-lowest coefficient, its statistical significance confirms that transportation remains an important component of construction materials management. Poor delivery systems and on-site transportation difficulties can delay material

availability and increase the likelihood of damage. The implication is that transportation planning should be integrated into procurement and site logistics decisions, particularly where construction sites have restricted access or materials must be moved over considerable distances.

Governmental factors recorded the lowest standardized coefficient ($\beta = 0.122$, $p = 0.006$), although the effect remained statistically significant. The relatively lower coefficient should not be interpreted as meaning that governmental conditions are unimportant. Rather, compared with the other variables in the model, government-related factors had the smallest relative predictive contribution. Customs delays, regulatory requirements and government policies can affect material procurement, particularly where materials or components depend on imported inputs. Construction firms therefore need to anticipate regulatory and customs-related uncertainties in procurement schedules and maintain appropriate contingency arrangements.

The findings collectively support a systems-oriented interpretation of materials management. No individual factor operates in isolation. For example, a contractor may have effective procurement procedures but still experience material shortages because of supplier delays. Similarly, reliable suppliers may not prevent material losses where site storage and handling arrangements are inadequate. The high R^2 of 0.778 demonstrates that considering these factors collectively provides a substantially better explanation of materials management effectiveness than examining individual operational activities in isolation.

The findings therefore extend previous materials management research by moving beyond the description of materials management practices to identify and quantify the relative contribution of the factors that shape their effectiveness. The strongest contribution of the study is the empirical demonstration that planning and handling, supplier coordination and managerial capability constitute the leading predictors of materials management effectiveness, while contractual, material, transportation and governmental conditions provide additional explanatory influence. This provides a basis for construction firms to prioritize interventions according to the relative influence of the factors rather than applying uniform materials management measures.

V. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study examined the factors influencing effective materials management practices among construction firms in Anambra State, Nigeria. The findings established that all eight identified factor categories significantly influence materials management effectiveness. Planning and handling factors ranked highest (group mean = 4.32), followed by site condition factors (4.18) and management factors (4.12). The regression results further showed a strong relationship between the identified factors and materials management effectiveness ($R = 0.882$; $R^2 = 0.778$; $F = 110.42$, $p < 0.001$), indicating that the factors jointly explained 77.8% of the variation in materials management effectiveness.

Planning and handling factors had the strongest predictive influence ($\beta = 0.214$), followed by suppliers and manufacturers' factors ($\beta = 0.198$) and management factors ($\beta = 0.178$). The study therefore concludes that effective materials management requires an integrated approach covering planning, supplier coordination, managerial control, site organization, material quality, transportation, contractual administration and regulatory support.

The study contributes to knowledge by empirically establishing the relative influence of these interconnected factors within the context of construction firms in Anambra State. Practically, it provides construction managers with evidence for prioritizing materials management interventions, while from a policy perspective, it highlights the need for improved regulatory and supply-chain conditions that support efficient construction material flows.

5.2 Recommendations

Based on the findings, the following recommendations are presented in order of priority:

1. Construction firms should improve materials forecasting, procurement scheduling, handling procedures, storage and material-flow coordination because planning and handling recorded the strongest influence (β = 0.214).
2. Firms should adopt formal supplier selection and performance-monitoring systems to improve delivery reliability, quality and procurement efficiency, given the significant influence of suppliers and manufacturers' factors (β = 0.198).
3. Project managers should improve supervision, communication, documentation, inventory monitoring and coordination because management factors recorded a significant influence (β = 0.178).
4. Firms should provide adequate storage facilities, reduce site congestion and organize material locations to address the significant influence of site condition factors (β = 0.162).
5. Clear specifications, quality inspection, inventory control, coordinated deliveries and proper transportation procedures should be strengthened in response to the significant contributions of contractual (β = 0.154), materials (β = 0.145) and transportation factors (β = 0.131).
6. Government agencies should streamline regulatory processes affecting construction materials, while firms should progressively adopt BIM, ERP and digital inventory systems to improve supply-chain coordination and material tracking.

5.3 Limitations of the Study

The study was limited to registered construction firms in Anambra State and relied on cross-sectional questionnaire data. Consequently, the findings may not be fully generalizable to other regions or informal construction firms. The study also focused on eight factor categories, meaning that other variables such as organizational culture, workforce competence, financial capacity, technological readiness and project complexity may explain part of the remaining 22.2% variation in materials management effectiveness.

5.4 Areas for Further Study

Future studies should examine materials management across other regions of Nigeria and compare firms of different sizes. Longitudinal studies are also recommended to examine changes in materials management effectiveness over project phases. Further research should investigate the effects of BIM, ERP, RFID and other digital technologies on material waste, inventory accuracy, procurement time and project performance. Qualitative and mixed-method studies could also provide deeper explanations of how organizational, supply-chain and regulatory factors interact to influence materials management effectiveness.

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